Ceramic Water Filters for the Developing World

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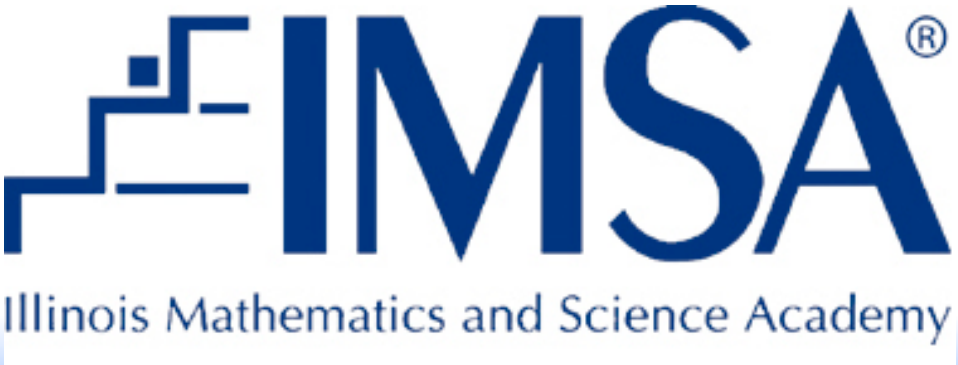

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Outline

- Topic 1 – Purpose and Goals
- Topic 2 – Ceramic Water Filters
- Topic 3 – Testing Methods
- Topic 4 – Disk Size Optimization
- Topic 5 – Composition Determination
- Topic 6 – Current Results
- Topic 7 – Filter Press
- Topic 8 – Future Research

Purpose and Goals

- Providing clean water to the billions of people who don't have access and/or can't afford it [1]
- Contaminants in water [2]
- Ceramic water filters [3]
  - Focus on disks
- Targets
  - 99% kill rate
  - 2 L/hr flow rate
  - Sustainable
  - $20 maximum price
  - Replicable

Ceramic Water Filters

- Ceramics are made by mixing clay and combustible materials with water and firing in a kiln [4]
- Porosity achieved through the burning of combustible materials
- Filters can be treated with a solution containing silver nanoparticles (AgNPs) to add antimicrobial potential [5]

Wet ceramic filter

Air-dried ceramic filter

Fired ceramic filter

Testing Methods

Making Filters:

- Press filters which are a mixture of clay and sawdust
- Fire disks in kiln
- “Paint” with silver nanoparticles

Experimental Setup:

- Attach disk to PVC pipe
- Add water to pipe
- Record amount of water in relation to time
- Plate and count bacterial samples

Disk Size Optimization

- Different sized disks yield different results
- Thickness and diameter varied and tested
  - Kill percentages are not independent of flow rates
- Optimum dimension reached: 15 cm diameter and 1.5 cm thickness

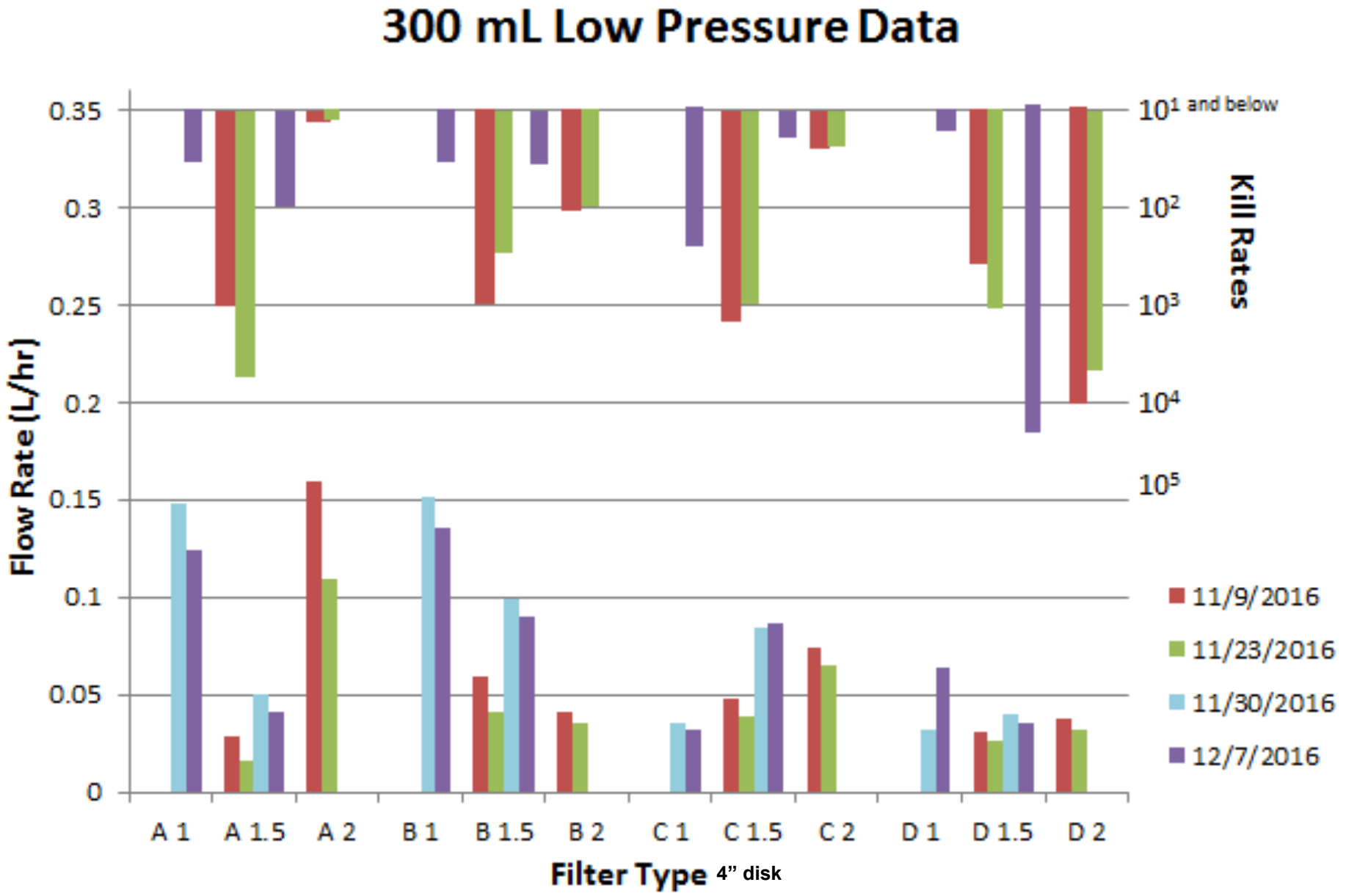
Composition Determination

- Base composition chosen from previous success
- Added 50 mL increments of sawdust to each to reach four primary compositions

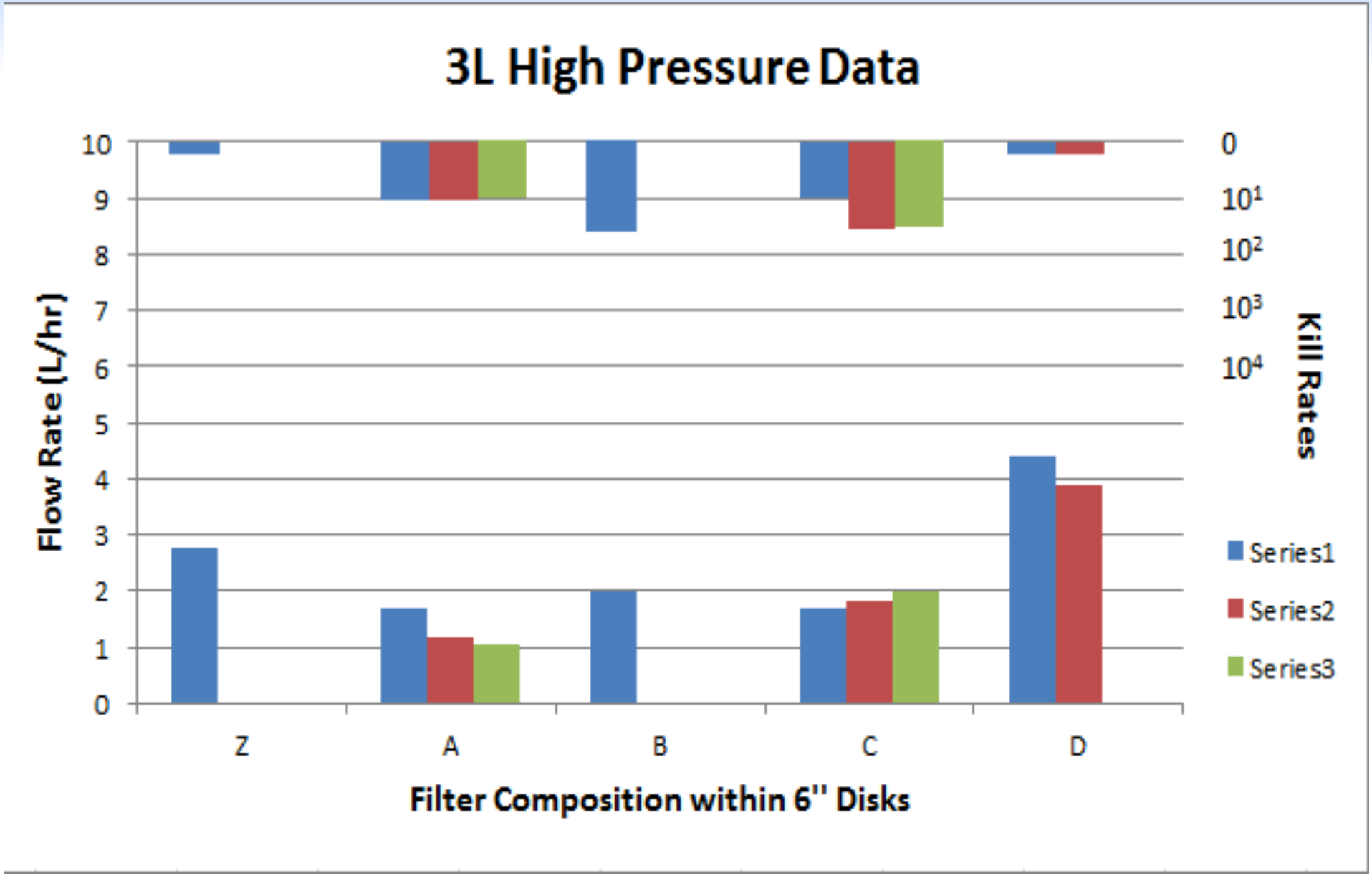
	Clay (ml)	Sawdust (ml)
A	250	275
B	275	325
C	275	350
D	275	375

- Z composition (50/50) added later
- Took weights of materials for more specific results later on

Current Results

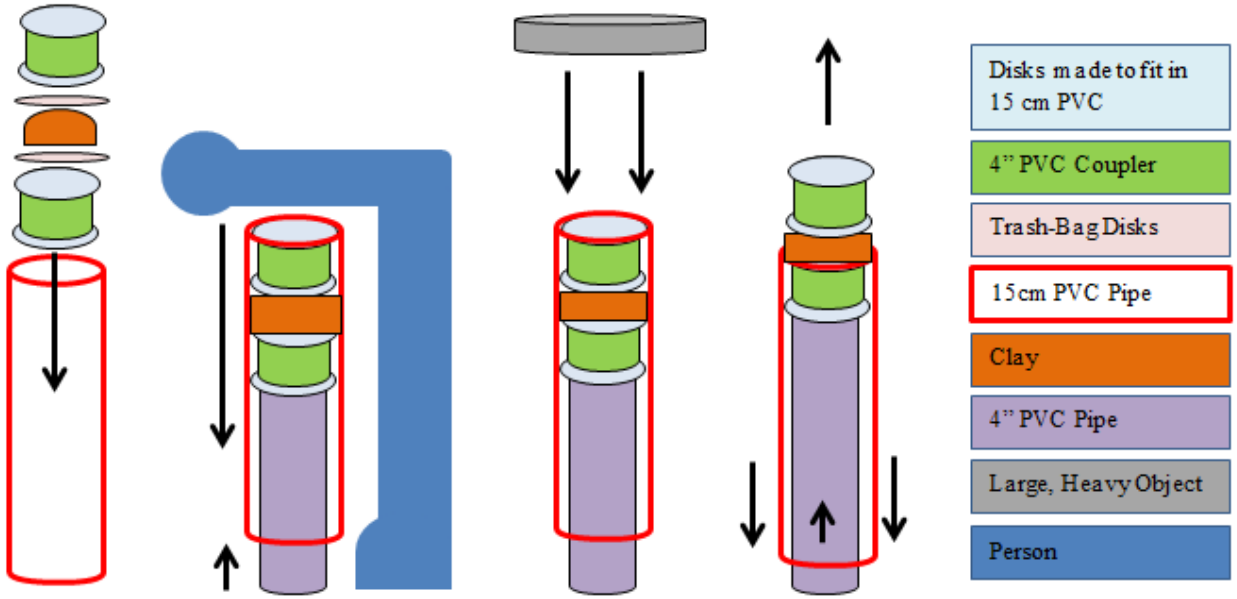


Current Results



Press

- Making our results:
  - Replicable
  - Realistic
  - Efficient
- Constant pressure mechanical press
- Instantaneous pressure simple press



Above: constant pressure mechanical press
Left: diagram displaying structure and use of instantaneous pressure simple press

Future Research

- Continue working towards a higher kill and flow rate
- Establish a more reliable consistency
  - Use press
- Test bacterial flow and kill rates over a long period of time
  - Siphoning system
  - Wider reservoir of water
- Other types of nanoparticles with antimicrobial potential
- Cost reduction

References

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[5] Nurani, S. J., Saha, C. K., Khan, A. R., & Sunny, S. M. (2015). Silver Nanoparticles Synthesis, Properties, Applications and Future Perspectives: A Short Review. Journal of Electrical and Electronics Engineering, 10(6), i, 117-126. doi: 10.9790/1676-1061117126.

Thank you!

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